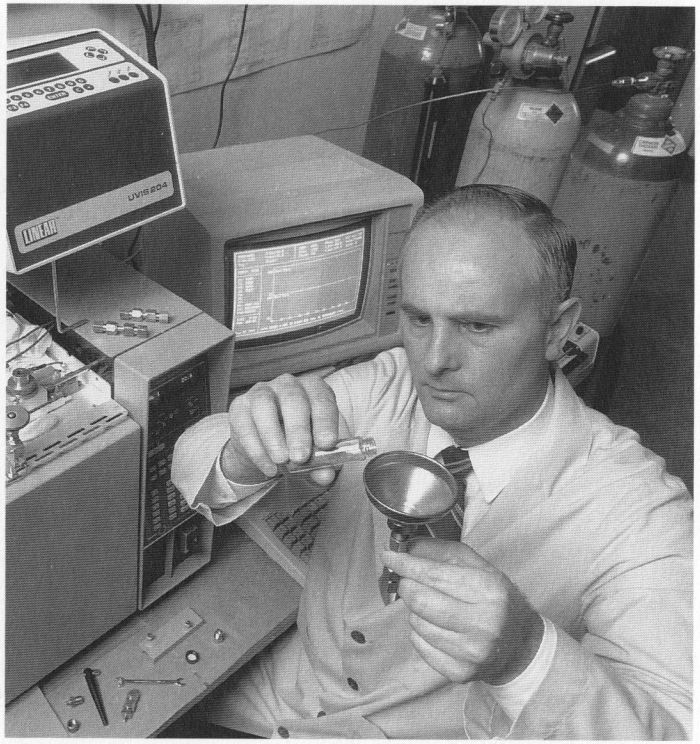
Supercritical Extraction

In the early 1980's, while working on a project involving high-pressure reactions, NRRC scientists at Peoria began to experiment with an intriguing property of carbon dioxide, reported earlier by German researchers. When subjected to a pressure of at least 1,100 pounds per square inch and held at a temperature above 31°C, carbon dioxide remains a gas but takes on the density and some of the properties of a liquid.

In this intermediate pressurized state, called supercritical by chemists, the carbon dioxide can flow through materials like flaked soybeans, corn germ, coffee, or spices, and dissolve the oils in those materials. In some cases, these oils contain the flavor essences. When the pressure is reduced, the carbon dioxide reverts to a gaseous state, leaving the liquid oil behind.

The first thought of NRRC chemists was that the process, which is completely safe and nonpolluting, could be substituted for current methods of extracting soybean oil with hexane, a petroleum derivative and an explosive solvent. Further research proved that the new process is indeed effective in extracting vegetable oils. But costs of plant conversions and problems in processing large quantities of oilseeds has so far discouraged adoption of supercritical extraction in the vegetable oil industry. There appear to be many immediate and practical uses for the process, however, and new applications are being found each year. Supercritical carbon dioxide can remove the caffeine from coffee, extract hops for flavoring beer, and refine many spices. At the Southern laboratory, it has been used to extract oil from dark-roasted peanuts with many more flavor and aroma components than oil extracted by pressing. An Italian scientist visiting the Peoria lab used the process to extract oil from the seeds of the evening primrose. The product was free of the chemical residue associated with hexane extraction. (Proponents of primrose oil, which sells for as much as $22 an ounce, insist that it is a remedy for a host of ailments, but the claims have yet to be proven to the satisfaction of U.S. medical scientists.)

Among the most practical uses of the carbon dioxide process is to analyze meat samples for pesticides and to check soil samples for possible contaminants. In lab experiments, lard samples were contaminated with lindane, endrin, and other pesticides and then subjected to supercritical extraction. Analysis disclosed that nearly 100 percent of the pesticides were removed by the process. Subsequent experiments with ground-up sausage and hams also proved the value of the extraction method in testing meat products. In 1989, the process was used to analyze soils suspected of containing high levels of organic compounds, such as animal and processing wastes. The carbon dioxide penetrated the soil samples easily and picked up organic compounds missed by other solvents. The process could help identify potential sources of groundwater pollution.



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